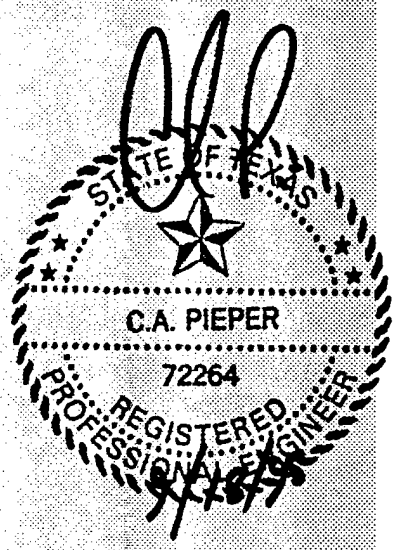
(EEAP) BOILER AND CHILLER STUDY

AT

FORT SAM HOUSTON

SAN ANTONIO, TEXAS

FINAL REPORT



US Army Corps of Engineers

Fort Worth Division

CONDUCTED BY

HUITT-ZOLLARS, INC.

CONSULTING ENGINEERS

FORT WORTH, TEXAS

9/18/95

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I. EXECUTIVE SUMMARY

A. Introduction

This energy conservation study was performed by Huitt-Zollars Inc, for the U.S. Army Engineer District (USAED), Fort Worth, under contract number DACAC63-94-D-0015. The study was conducted at Fort Sam Houston (FSH) in San Antonio, Texas, between November 28, 1994 and June 15, 1995. The site survey, data collection and analysis was performed by John Carter, E.I.T, Tom Holthaus, P.E., Walter H. Williams III, P.E., and C.A. Pieper, P.E..

The purpose of the study was to perform a limited site survey of specific buildings at the facility, identify specific Energy Conservation Opportunities (ECOs) that exist, and then evaluate these ECOs for technical and economic feasibility. These ECOs were limited to central boiler and chiller plant systems serving specific building groups at FSH.

This survey was conducted with the assistance of many individuals at the FSH facility. Special thanks are extended to all of them, including the following individuals:

Gerardo De La Pena, Energy Coordinator
Frank Carbonell, Engineering Service
Gene Rodriguez, Engineering Service
Ray Mendoza, Engineering Service
Mike Brynes, Operations and Maintenance
Henry Guerra, Operations and Maintenance
Al Mote, Energy Program Specialist

Other individuals who assisted in this study by providing equipment and cost data are listed as follows:

Tom McGreal, York International, Dallas, TX
John Neal, Sr., Neal and Associates, Dallas, TX
Joe Scolaro and Brian Mitchell, Mitchell Technical Sales, Dallas, TX
Preston Dickson, Timberlake and Woffard, Inc., Dallas, TX
Larry Carpenter, The Trane Company, Fort Worth, TX
David Recca, DynaService, Fort Worth, TX

Any questions concerning this report should be directed to the Project Manager at Huitt-Zollars Inc., 512 Main Street, Suite 1500, Fort Worth, Texas 76102. Phone 817-335-3000.

B. Buildings Studied

This study was performed on five separate groups of buildings at the Fort Sam Houston installation in San Antonio, Tx. These groups were identified as areas 100, 900, 1300, 2200 and Quadrangle. Buildings in each of these areas are briefly described as follows:

Area 100: These twenty buildings are currently used as office buildings, barracks, and other miscellaneous things such as a band rehearsal hall.

Area 900: These buildings consisted of sixteen barracks, four smaller support buildings and one large administrative building, all occupied by army personnel.

Area 1300: The buildings in this group consisted of six barracks, one dining hall and one administrative office building.

Area 2200: The four buildings in this group consisted of three barracks and one administrative office building, which were all approximately 25 years old.

Quadrangle: The four buildings in this group are all administrative offices, one of which serves as the headquarters of the 5th Army.

C. Present Energy Consumption

Base Year Energy Consumption: The total metered electrical and gas consumptions for 12 consecutive months, prior to this study, were obtained from the facility and are referred to as the 'base year'. These data are shown on page 12 and are summarized as follows:

Figure 1. Base Year Energy Usage By Source

ENERGY SOURCE	ANNUAL USAGE		COST $
Electricity	153,580 MWH	524,169 MMBTU	6,567,101
Natural Gas	51,415 MCF	51,415 MMBTU	192,985
Total		575,584 MMBTU	6,760,086

Boiler & Chiller Systems Energy Consumption: The annual energy consumption for the boiler & chiller systems studied was calculated in Appendix B, using the Trace 600 computer program to model the buildings and HVAC systems. This consumption amounted to a total of 11.1% of the base year energy usage and 7.4% of the energy costs. These system energy consumptions are given as follows:

Figure 2. Annual Boiler & Chiller Systems Energy Consumption

AREA	COOLING SYSTEM DEMAND $/YR	COOLING SYSTEM ELECT. KWH/YR	COOLING SYSTEM ELECT. $/YR	HEATING SYSTEM DEMAND $/YR	HEATING SYSTEM ELECT. KWH/YR	HEATING SYSTEM ELECT. $/YR	HEATING SYSTEM GAS MCF/YR	HEATING SYSTEM GAS $/YR
100	46,621	1,687,278	35,433	1,269	89,804	1,886	1,927	5,126
900	13,242	621,339	13,048	1,000	88,213	1,852	7,809	20,771
1300	67,861	3,019,253	63,404	2,687	259,249	5,444	18,751	49,878
2200	36,390	1,609,767	33,805	797	51,536	1,082	4,949	13,163
QUAD	51,292	1,633,303	34,299	221	6,096	128	1,210	3,220
SUBTOTALS	215,405	8,570,940	179,990	5,973	494,898	10,393	34,646	92,158
ANNUAL BOILER & CHILLER SYSTEM ENERGY				63,898 MMBTU/YR				
ANNUAL BOILER & CHILLER SYSTEM COST, $/YR				503,919 $/YR				

D. Energy Conservation Opportunity (ECO) Analysis

ECOs Rejected: After reviewing the data collected at the facility and considering all of the practical limitations involved, there were no potential ECOs which were rejected prior to performing calculations. Therefore, energy savings calculations were performed for all ECOs identified in the scope of work.

ECOs Recommended: Certain ECOs which were identified during the building survey have been evaluated for technical and economic feasibility and are recommended for implementation. Complete documentation of all calculations as well as information required for implementation is included in Appendix D. These recommended ECOs are summarized in order of descending Savings to Investment Ratio (SIR) in Table 1 on page 6.

ECOs Not Recommended: Certain ECOs which were identified during the building survey have been evaluated for technical and economic feasibility but are not recommended for implementation. Complete documentation of all calculations are included in Appendix E. These non-recommended ECOs are summarized in order of order of descending SIR in Table 2 on page 6.

ECIP Projects Developed: The facility will submit three projects for ECIP funding, from the recommended ECOs shown in Table 1. The DD-1391 forms needed to request ECIP funding for each project are included in this report. These projects are listed below in order of descending SIR.

ECIP Project	Description	Cost $	Payback yrs	SIR
1	Chiller Retrofits, Areas 2200 & 900, Boiler Retrofit, Area 1300	558,058	7.7	2.27
2	Chiller Retrofit, Area 1300	479,191	8.4	1.98
3	New Central Chiller Plant, Area 100	556,559	8.6	1.73

Non-ECIP Projects Developed: The facility will also submit all ECOs indivudually as projects for non-ECIP funding. The DD-1391 forms needed to request non-ECIP funding for each project are included in this report. These projects are listed below in order of descending SIR.

Non-ECIP Project	Description	Cost $	Payback yrs	SIR
1	Chiller Retrofit, Area 2200	237,078	6.3	2.73
2	Chiller Retrofit, Area 900	157,256	8.9	2.08
3	Chiller Retrofit, Area 1300	479,191	8.4	1.98
4	Boiler Retrofit, Area 1300	163,724	9.6	1.79
5	New Central Chiller Plant, Area 100	556,559	8.6	1.73

Recommended Maintenance & Operations Practices: The following maintenance and operations (M&O) practices are recommended to help conserve boiler and chiller plant energy at FSH.

1. The Energy Coordinator and the FSH Director of Public Works should develop a master plan specification for all future central boiler and chiller plant maintenance and renovation projects. All facility project managers, as well as any central plant maintenance contractors should be required to follow this specification. The energy coordinator should review all new central boiler and chiller plant designs to check for compliance with the specifications.

2. The energy coordinator should attend training seminars for building energy.

3. The installation should increase the size of their current maintenance staff by adding trained HVAC technicians.

4. The installation should provide technical training for it's current HVAC staff, especially in the area of HVAC controls.

5. Revise the current HVAC preventative maintenance program as needed to improve the overall condition of the existing systems and equipment. The Energy Manager should be involved in this process to ensure that energy conservation concerns are addressed.

6. Add status, alarm, start and stop capabilities for all central boiler and chiller systems and auxiliaries to the post's existing building automation system. This will allow the maintenance staff to have better monitoring and control capabilities than they currently have.

7. Repair or replace all building HVAC control systems to improve space temperature control and conserve heating and cooling system energy.

E. Energy And Cost Savings

Total Potential Energy and Cost Savings. The energy and cost savings from the implementation of all ECIP projects was calculated as follows:

Electrical Energy Savings	8,690	MMBTU/yr
Electrical Demand Savings	49,884	$/yr
Gas Energy Savings	4,020	MMBTU/yr
Total Energy Savings	12,710	MMBTU/yr
Total Cost Savings	193,496	$/yr
Total Investment	1,593,808	$
Simple Payback	8.2	yrs

Energy Use and Costs Before and After. Based on the base year electrical and gas energy consumptions and costs shown on page 12, and the calculated total potential savings above, the FSH energy and usage and costs before and after implementation of the 3 Non-ECIP projects is as follows:

	Before	After
Electrical	153,580 MWH	151,033 MWH
Gas	51,415 MCF	47,395 MCF
Total Cost	6,760,086 $	6,566,590 $

Percentage Saved. Based on the base year electrical and gas energy consumptions and costs, the percentage of savings from the 3 projects is as follows:

$$\textit{Electrical Energy Saved} = \left[\frac{2{,}546\ MWH}{153{,}580\ MWH}\right] = 1.6\%$$

$$\textit{Gas Energy Savings} = \left[\frac{4{,}020\ MCF}{51{,}415\ MCF}\right] = 7.8\%$$

$$\textit{Energy Cost Savings} = \left[\frac{193{,}496\ \$}{6{,}760{,}086\ \$}\right] = 2.8\%$$

TABLE 1. ENERGY CONSERVATION OPPORTUNITIES (ECOs) RECOMMENDED

ECO	Description	Electrical Energy Savings MMBTU/yr	Electrical Demand Savings $/yr	Gas Energy Savings MMBTU/yr	Total Energy Savings MMBTU/yr	Total Cost Savings $/yr	Total Investment $	Simple Payback Yrs	SIR
	AREA 2200								
E	Replace Existing Chiller With New Centrifugal Chiller	1,304	11,822	0	1,304	37,433	237,078	6.3	2.73
	AREA 900								
A	Replace Existing Central Chiller with Screw Chiller	434	2,520	0	434	17,650	157,256	8.9	2.08
	AREA 1300								
C	Replace Existing Chillers With Centrifugal Chillers	3,424	13,914	0	3,424	56,936	479,191	8.4	1.98
	AREA 1300								
D	Replace Existing Boilers With High % Modular Boilers	712	1,847	4,020	4,732	17,012	163,724	9.6	1.79
	AREA 100								
I	Replace Individual Chillers With Central Chiller Plant	2,816	19,781	0	2,816	64,465	556,559	8.6	1.73
	Totals	8,690	49,884	4,020	12,710	193,496	1,593,808	8.2	

TABLE 2. ENERGY CONSERVATION OPPORTUNITIES (ECOs) NOT RECOMMENDED

ECO	Description	Electrical Energy Savings MMBTU/yr	Electrical Demand Savings $/yr	Gas Energy Savings MMBTU/yr	Total Energy Savings MMBTU/yr	Total Cost Savings $/yr	Total Investment $	Simple Payback Yrs	SIR
	AREA 900								
B	Replace Existing Boilers With High % Modular Boilers	0	0	1,235	1,235	3,285	50,591	15.4	1.21
	QUADRANGLE AREA				0				
G	Replace Existing Chillers With Central Chiller Plant	2,212	14,116	0	2,212	39,257	824,178	20.9	0.71
	AREA 2200				0				
F	Replace Existing Boilers With High % Modular Boilers	38	378	910	948	3,037	78,553	25.8	0.69
	AREA 100				0				
J	Replace Existing Boilers With Central Boiler Plant	186	680	680	866	11,483	273,951	23.8	0.66
	QUADRANGLE AREA								
H	Replace Existing Boilers With Central Boiler Plant	-12	122	-434	-446	5,542	394,910	71.2	0.20
	Totals	18,066	100,722	10,431	28,497	394,513	4,415,465	11.2	